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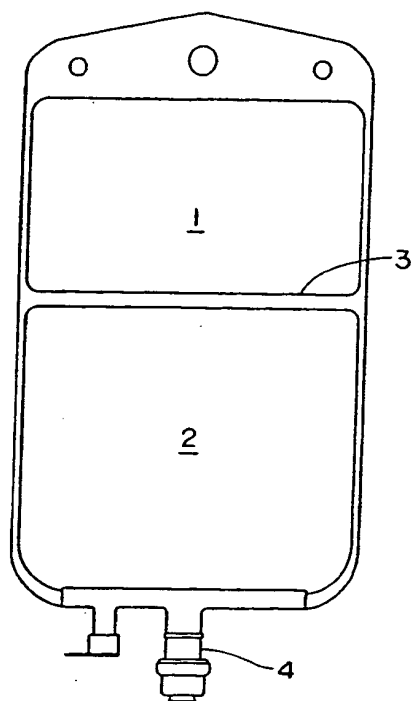
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D-81925 München (DE)(54) **MULTILAYERED FILM AND CONTAINER.**

(57) A multilayered film composed of the outer layer comprising a linear ethylene/ α -olefin copolymer having a density of 0.920-0.950 g/cm³, the intermediate layer comprising a linear ethylene/ α -olefin copolymer having a density of 0.920 g/cm³ or less, and the inner layer comprising a resin composed of a linear ethylene/ α -olefin copolymer having a density of 0.940 g/cm³ or less and containing 20-40 wt.% of polypropylene, wherein a high-density polyethylene having a density of 0.960 g/cm³ or above is incorporated in all of the outer, intermediate and inner layers in amounts of, respectively, 15-55 wt.%, 15-55 wt.% and 5-50 wt.%; and a container made by molding the above film, which is free from the fear of sealing strength lowering, deformation, transparency lowering, and the like even when sterilized at a temperature as high as 120 °C or above and can provide a double-compartment container having a stabilized, easy-to-peel sealing part, thus being suitable for use as a transfusion bag.

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Fig. 1



TECHNICAL FIELD

The present invention relates to a multi-layer film and a container molded using the same. More particularly, it relates to a multi-layer film used for a container having a plurality of chambers which is suitably used for containing a liquid medicine, etc., in the medical field, said container capable of separately containing two or more kinds of medicines and mixing them on use, and a container using the same.

BACKGROUND OF THE INVENTION

Heretofore, in medical plastic containers, various containers having a plurality of chambers have been studied so as to enable them to contain separately two or more kinds of medicines, e.g. amino acid solution and sugar electrolyte solution, antibiotic and liquid for dissolving the same, etc., to mix them aseptically on use. Example thereof include a container wherein an easy peelable seal part is formed between two chambers using a resin mixture of polyethylene and polypropylene (Japanese Laid-Open Patent Publication No. 2-4671).

However, since heat resistance is not sufficiently taken into consideration in the above container, a sealing strength and drop-shock resistance are deteriorated by sterilization under high-temperature condition such as high-pressure steam sterilization, hot-water sterilization, etc and, further, deformation is arisen and transparency and flexibility are deteriorated. Particularly, when the temperature condition of the sterilization is set at a severe condition, i.e. not less than 120 °C, not only a strength is drastically reduced but also serious failure such as deterioration of the easy peelable seal part is arisen.

On the other hand, there have been proposed a medical bag having a three-layer structure wherein a resin composition composed of a radical-polymerized low-density polyethylene having a density of not more than 0.930 g/cm³ and a high-density polyethylene having a density of not less than 0.945 g/cm³ is used for inner and outer layers, and a resin composition composed of a linear low-density polyethylene having a density of not more than 0.920 g/cm³ and a high-density polyethylene having a density of not less than 0.945 g/cm³ are used as an intermediate layer (Japanese Laid-Open Patent Publication No. 4-266759) in order to improve heat resistance.

However, the above container has not satisfactory heat resistance yet and it is not taken into consideration at all to provide an easy peelable seal part and, therefore, it can not be used for a container having a plurality of chambers, as a matter of course.

It is a main object of the present invention to provide a multi-layer film having high heat resistance enough to endure the high-temperature sterilization as described above, wherein an easy peelable seal part causes no weld by a sterilization treatment when it is used for a container having a plurality of chambers, and a container molded using the same.

It is another object of the present invention to provide a multi-layer film having excellent strength, flexibility and transparency, and a container molded using the same.

DISCLOSURE OF THE INVENTION

According to the present invention, there is provided the following multi-layer film and container.

That is, the multi-layer film of the present invention is a multi-layer film composed of a polyolefin resin, comprising:

- (1) an outer layer containing a linear ethylene- α -olefin copolymer having a density of 0.920 to 0.950 g/cm³;
- (2) an intermediate layer having at least one layer containing a linear ethylene- α -olefin copolymer having a density of not more than 0.920 g/cm³; and
- (3) an inner layer containing a resin in which 20 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of not more than 0.940 g/cm³;

wherein a high-density polyethylene having a density of not less than 0.960 g/cm³ is contained in all layers, and an amount of the high-density polyethylene in the outer and intermediate layers is within a range from 15 to 55 % by weight and that in the inner layer is within a range from 5 to 50 % by weight.

According to the preferred embodiment of the present invention, there is provided a multi-layer film wherein an inner layer is composed of a resin wherein 25 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of 0.920 to 0.940 g/cm³ and a high-density polyethylene having a density of not less than 0.960 g/cm³, an amount of the high-density polyethylene being within a range from 5 to 20 % by weight.

According to the more preferred embodiment of the present invention, there is provided a multi-layer film, comprising:

- (1) an outer layer containing a linear ethylene- α -olefin copolymer having a density of 0.930 to 0.945 g/cm³;
 - 5 (2) an intermediate layer having at least one layer containing a linear ethylene- α -olefin copolymer having a density of 0.885 to 0.905 g/cm³; and
 - (3) an inner layer containing a resin in which 20 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of 0.930 to 0.940 g/cm³;
- wherein a high-density polyethylene having a density of not less than 0.960 g/cm³ is contained in all 10 layers, and an amount of the high-density polyethylene in the outer and intermediate layers is within a range from 15 to 55 % by weight and that in the inner layer is within a range from 5 to 50 % by weight.

According to the still more preferred embodiment of the present invention, there is provided a multi-layer film, which comprises:

- (1) an outer layer containing a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
 - 15 (2) an intermediate layer having at least one layer containing a linear ethylene- α -olefin copolymer having a density of 0.905 g/cm³ or 0.885 g/cm³; and
 - (3) an inner layer containing a resin in which 20 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³ or 0.940 g/cm³;
- wherein a high-density polyethylene having a density of not less than 0.960 g/cm³ is contained in all 20 layers, and an amount of the high-density polyethylene in the outer and intermediate layers is within a range from 15 to 35 % by weight and that in the inner layer is within a range from 5 to 20 % by weight.

Examples of the embodiment of this multi-layer film include the following multi-layer films, comprising:

First Embodiment:

- 25 (1) an outer layer composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- (2) an intermediate layer composed of a resin in which 30 % by weight of a high-density polyethylene 30 having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.905 g/cm³; and
- (3) an inner layer composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ and 30 % by weight of polypropylene having a density of 0.910 g/cm³ are 35 contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³;

Second Embodiment:

- 40 (1) an outer layer composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- (2) an intermediate layer composed of a resin in which 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.885 g/cm³; and
- 45 (3) an inner layer composed of a resin in which 14 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ and 33 % by weight of polypropylene having a density of 0.910 g/cm³ are contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³; and

Third Embodiment:

- 50 (1) an outer layer composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- (2) an intermediate layer composed of a first layer of a resin in which 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having 55 a density of 0.905 g/cm³, a second layer of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³ and a third layer of a resin wherein 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having

a density of 0.905 g/cm³; the first layer, the second layer and the third layer being laminated each other in this order and

(3) an inner layer composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ and 30 % by weight of polypropylene having a density of 0.910 g/cm³ are contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³. Further, examples of the high-density polyethylene having a density of 0.965 g/cm³ include those which have a melt flow rate of 15 g/10 minute (190 °C).

The container of the present invention is a container molded using the above film, especially comprising two or more chambers, the respective chambers being partitioned by an easy peelable seal part formed by directly heat-sealing inner surfaces of the above films each other.

BRIEF EXPLANATION OF DRAWINGS

Fig. 1 is a plan view illustrating the container having a plurality of chambers of the present invention.

Fig. 2 is a side view illustrating the container having a plurality of chambers of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

The linear ethylene- α -olefin copolymer used for the film of the present invention is a linear structure resin having a short-chain branch which is obtained by copolymerizing ethylene with α -olefin as a main component by means of a low-pressure method. Examples of α -olefin include those having 3 to 12 carbon atoms, such as propylene, 1-butene, 1-pentene, 1-hexene, 4-methyl-1-pentene, 1-heptene, 1-octene, 1-nonene, 1-decene, 1-undecene, 1-dodecene and the like. Among them, 1-butene and 4-methyl-1-pentene can be suitably used. A copolymer constituting each layer has the following properties, respectively.

Outer Layer

Since excellent mechanical strength and heat resistance are required in addition to transparency and flexibility, a density of the linear ethylene- α -olefin copolymer is selected within a range from 0.920 to 0.950 g/cm³, and those having a density of 0.930 to 0.945 g/cm³ are particularly preferred. It is preferred to use those having a melt flow rate (hereinafter referred to as "MFR") of 0.1 to 20 g/10 minutes, preferably 0.2 to 10 g/10 minutes, particularly 0.5 to 5 g/10 minutes. The outer layer is composed of a blend of this linear ethylene- α -olefin copolymer and a high-density polyethylene described later.

Intermediate Layer

It is necessary to use a resin having high flexibility, shock resistance and transparency, and a linear ethylene- α -olefin copolymer having a density of not more than 0.920 g/cm³ is used. Preferred examples of the copolymer include those having a density of 0.880 to 0.920 g/cm³, more preferably 0.885 to 0.915 g/cm³, particularly 0.885 to 0.905 g/cm³. Further, it is preferred to use those having MFR of 0.1 to 20 g/10 minutes, preferably 0.2 to 10 g/10 minutes, particularly 0.5 to 5 g/10 minutes.

Further, the intermediate may be composed of one layer, but it can be molded into a multi-layer structure with the other kind of the linear ethylene- α -olefin copolymer. In that case, as the other copolymer, there can be used the same copolymer as that used for the inner layer described later. As a matter of course, the high-density polyethylene is contained in all layers. Further, the intermediate layer can also be molded into a multi-layer structure of layers containing a different amount of the high-density polyethylene.

Inner Layer

By using a resin in which 20 to 40 % by weight, preferably 25 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of not more than 0.940 g/cm³, the resulting layer can endure sterilization under the high-temperature condition. Further, by directly heat-sealing inner surfaces of the respective films each other, an easy peelable seal part can be formed. It is preferred that a density of the linear ethylene- α -olefin copolymer is selected within a range from 0.920 to 0.940 g/cm³, and those having a density of 0.930 to 0.940 g/cm³ are particularly preferred. Further, it is preferred to use those having MFR of 0.1 to 20 g/10 minutes, preferably 0.2 to 10 g/10 minutes, particularly 0.5 to 5 g/10 minutes. As the polypropylene, there may be contained a homopolymer, or a copolymer with a small amount of olefin such as ethylene, 1-butene, etc. (normally not more than 10 % by weight,

preferably not more than 5 % by weight). It is preferred to use those having MFR of 0.1 to 60 g/10 minutes, preferably 1.0 to 40 g/10 minutes, particularly 1.5 to 25 g/10 minutes. The inner layer is composed of the above resin and a high-density polyethylene described later.

As the high-density polyethylene contained in the respective layers of the film of the present invention, there can be used a homopolymer of ethylene, or a copolymer with α -olefin such as 1-butene, 1-hexene, 4-methyl-1-pentene and the like. It is preferred to use those having a density of 0.960 to 0.970 g/cm³, preferably those having MFR of 10 to 30 g/10 minutes. Among these high-density polyethylenes, those having Mw/Mn (Mw is a weight-average molecular weight determined by gel permeation chromatography (GPC) and Mn is a number-average molecular weight determined by GPC), which indicates molecular-weight distribution, of not more than 4.0, particularly not more than 3.5 is preferred so as to maintain transparency of the film.

An amount of the high-density polyethylene is 15 to 55 % by weight, preferably 15 to 35 % by weight in the outer and intermediate layers. The amount is 5 to 50 % by weight, preferably 5 to 20 % by weight in the inner layer. When the amount is smaller than the above range, sufficient heat resistance can not be obtained. On the other hand, when the amount is larger than the above range, flexibility and transparency are deteriorated.

Regarding the multi-layer film formed by the above respective resin layers of the present invention, it is suitable for medical film that a total thickness is 100 to 700 μ m, preferably 150 to 300 μ m. It is preferred that a ratio of a thickness of the respective layers (outer layer:intermediate layer:inner layer) is 5 to 30:90 to 40:5 to 30, preferably 5 to 25:90 to 50:5 to 25, more preferably 5 to 20:90 to 60:5 to 20.

As a production process of the film of the present invention, there can be used co-extrusion inflation process followed water-cooling or air-cooling, T-die co-extrusion method, Dry lamination method, extrusion lamination method and the like. In view of properties, particularly transparency, economy, sanitation, etc., co-extrusion inflation process followed water-cooling and T-die co-extrusion method are preferred. The condition of the above production process may be set to a suitable temperature, rate, etc. so as not to cause deterioration of the resin.

The container having a predetermined shape and size of the present invention can be produced by cutting a blown or flat film thus obtained by the above method, heat-sealing the film and providing it with an opening member by a means such as heat-sealing. Particularly, when a container having a plurality of chambers is produced, an easy peelable seal part between the respective chamber can be formed by heat-sealing under the mild condition in comparison with the heat-sealing condition of a peripheral edge part. Examples of the container having a plurality of chambers include that shown in Fig. 1 and Fig. 2. That is, a container having a plurality of chambers shown in Fig. 1 and Fig. 2 has two chambers 1, 2, and these chambers 1, 2 are partitioned by an easy peelable seal part 3. The chamber 2 is provided with an opening member 4.

FIELD OF INDUSTRIAL APPLICABILITY

Regarding the multi-layer film and container of the present invention, a sealing strength and drop-shock resistance are not decreased even if sterilization under the severe temperature condition, i.e. not less than 120 °C, is conducted and, further, no deformation is arisen and transparency and flexibility are not deteriorated. Besides, when the container of the present invention is molded into a container having a plurality of chambers, the easy peelable seal part between the respective chambers can be formed by directly heat-sealing under the mild condition in comparison with the heat-sealing condition of the peripheral edge part. Therefore, a troublesome step of inserting an easy peelable tape between films is not required and it becomes easy to mold the container having a plurality of chambers. Further, regarding the container having a plurality of chambers thus obtained, the easy peelable seal part is stable after sterilization and medicines contained separately are not mixed each other. Therefore, the resulting container can be suitably used as a medical container such as infusion bag, etc.

EXAMPLES

The following Examples and Comparative Examples further illustrate the present invention in detail but are not to be construed to limit the scope thereof.

The respective resins will be shown by the following abbreviations. Further, MFR was determined by a method according to ASTM D 1238.

(1) HP: high-density polyethylene (ethylene-1-butene copolymer) [manufactured by MITSUI PETRO-CHEMICAL INDUSTRIES, LTD., density: 0.965 g/cm³, MFR: 15 g/10 minutes (190 °C), Mw/Mn: 2.8]

- (2) PE①: linear moderate-density polyethylene (ethylene-1-butene copolymer) [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.940 g/cm³, MFR: 2.1 g/10 minutes (190 °C)]
- (3) PE②: linear low-density polyethylene (ethylene-1-butene copolymer) [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.905 g/cm³, MFR: 1.4 g/10 minutes (190 °C)]
- 5 (4) PE③: linear low-density polyethylene (ethylene-1-butene copolymer) [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.895 g/cm³, MFR: 1.0 g/10 minutes (190 °C)]
- (5) PE④: linear moderate-density polyethylene (ethylene-1-butene copolymer) [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.930 g/cm³, MFR: 2.1 g/10 minutes (190 °C)]
- 10 (6) PE⑤: linear low-density polyethylene (ethylene-1-butene copolymer) [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.885 g/cm³, MFR: 5.0 g/10 minutes (190 °C)]
- (7) PP①: isotactic polypropylene [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.910 g/cm³, MFR: 7.1 g/10 minutes (230 °C)]
- (8) PP②: isotactic polypropylene [manufactured by MITSUI PETROCHEMICAL INDUSTRIES, LTD., density: 0.910 g/cm³, MFR: 3.0 g/10 minutes (230 °C)]
- 15 Firstly, the respective laminating sheets (synthetic resin to be used and construction of layer are as shown in Table 1) were produced by means of a water-cooling coextrusion inflation process followed water-cooling. Then, a 500 ml medical bag having two chambers as shown in Fig. 1 and Fig. 2 was molded using the respective laminating sheet. The heat-sealing condition at the time of molding was set to a temperature of 180 °C for 4 seconds at the peripheral edge part of the bag, and a temperature of 140 °C for 3 seconds
- 20 at the easy peelable seal part.

In Table 1, for example, the outer layer of Example 1 means a layer having a thickness of 15 μ m obtained by mixing PE① with HP in a weight ratio (PE①/ HP = 80/20).

Table 1

25

	Outer layer (μ m)	Intermediate layer (μ m)			Inner layer (μ m)
30 Example 1	PE① + HP 80:20 (15)	PE② + HP 70:30 (170)			PE④ + HP + PP① 50:20:30 (15)
Example 2	PE① + HP 80:20 (15)	PE③ + HP 50:50 (170)			PE④ + HP + PP① 50:20:30 (15)
35 Example 3	PE① + HP 80:20 (15)	PE② + HP 80:20 (80)	PE④ + HP 80:20 (10)	PE② + HP 80:20 (80)	PE④ + HP + PP① 50:20:30 (15)
Example 4	PE① + HP 80:20 (15)	PE② + HP 70:30 (80)	PE④ + HP 80:20 (10)	PE② + HP 70:30 (80)	PE④ + HP + PP① 50:20:30 (15)
40 Example 5	PE① + HP 80:20 (15)	PE③ + HP 50:50 (80)	PE④ + HP 80:20 (10)	PE③ + HP 50:50 (80)	PE④ + HP + PP① 50:20:30 (15)
Example 6	PE① + HP 80:20 (30)	PE⑤ + HP 80:20 (115)			PE① + HP + PP② 60:7:33 (30)
45 Example 7	PE① + HP 80:20 (30)	PE⑤ + HP 70:30 (115)			PE① + HP + PP② 53:14:33 (30)
Example 8	PE① + HP 80:20 (15)	PE⑤ + HP 70:30 (60)	PE⑤ + HP 50:50 (10)	PE⑤ + HP 70:30 (60)	PE① + HP + PP② 53:14:33 (30)
50 Comp.Ex. 1	PE① + HP 90:10 (15)	PE② + HP 90:10 (80)	PE④ + HP 90:10 (10)	PE② + HP 90:10 (80)	PE④ + HP + PP① 60:10:30 (15)
Comp.Ex.2	PE① + HP 80:20 (15)	PE② (80)	PE④ (10)	PE② (80)	PE④ + HP + PP① 50:20:30 (15)
55 Comp.Ex.3	PE① (15)	PE② + HP 90:10 (80)	PE④ + HP 90:10 (10)	PE② + HP 90:10 (80)	PE④ + PP① 70:30 (15)

The medical container thus obtained was filled with water and subjected to a high-pressure steam sterilization treatment at 121 °C for 30 minutes. Then, a state of deformation, breakage, wrinkle and

blocking was examined by visual observation and the results were taken as an index of heat resistance. Similarly, a cloudy state of the container was examined and the results were taken as an index of transparency. In addition, natural discharging properties of the content solution were examined by visual observation and the results were taken as an index of flexibility. Further, a state of heat-sealing of the peripheral edge part and the easy peelable seal part of the medical container before and after sterilization treatment were observed visually and the resulting heat-sealing states were taken as an index of sealing properties. Furthermore, an overall judgment was conducted according to these all indices. The results are shown in Table 2.

In Table 2, the symbol "◎" indicates "very good", "○" indicates "good", "x" indicates "inferior" and "-" indicates "impossible to measure". As apparent from Table 2, the film and container of the present invention can endure high-temperature sterilization sufficiently and its strength, flexibility and transparency are maintained.

Table 2

	Heat resistance	Flexibility	Transparency	Sealing properties	Judgement
Example 1	◎	◎	◎	◎	◎
Example 2	◎	◎	◎	◎	◎
Example 3	○	○	○	○	○
Example 4	◎	◎	◎	◎	◎
Example 5	◎	◎	◎	◎	◎
Example 6	◎	◎	◎	◎	◎
Example 7	◎	◎	◎	◎	◎
Example 8	◎	◎	◎	◎	◎
Comp.Ex. 1	X	X	X	X	X
Comp.Ex. 2	X	-	-	X	X
Comp.Ex. 3	X	-	-	X	X

Claims

1. A multi-layer film composed of a polyolefin resin, comprising:
 - (1) an outer layer containing a linear ethylene- α -olefin copolymer having a density of 0.920 to 0.950 g/cm³;
 - (2) an intermediate layer having at least one layer containing a linear ethylene- α -olefin copolymer having a density of not more than 0.920 g/cm³; and
 - (3) an inner layer containing a resin in which 20 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of not more than 0.940 g/cm³;
 wherein a high-density polyethylene having a density of not less than 0.960 g/cm³ is contained in all layers, and an amount of the high-density polyethylene in the outer and intermediate layers is within a range from 15 to 55 % by weight and that in the inner layer is within a range from 5 to 50 % by weight.
2. The multi-layer film according to claim 1, wherein the inner layer is composed of a resin in which 25 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of 0.920 to 0.940 g/cm³ and a high-density polyethylene having a density of not less than 0.960 g/cm³, and an amount of the high-density polyethylene is within a range from 5 to 20 % by weight.
3. A multi-layer film composed of a polyolefin resin, comprising:
 - (1) an outer layer containing a linear ethylene- α -olefin copolymer having a density of 0.930 to 0.945 g/cm³;

- (2) an intermediate layer having at least one layer containing a linear ethylene- α -olefin copolymer having a density of 0.885 to 0.905 g/cm³; and
- (3) an inner layer containing a resin in which 20 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of 0.930 to 0.940 g/cm³;
- 5 wherein a high-density polyethylene having a density of not less than 0.960 g/cm³ is contained in all layers, and an amount of the high-density polyethylene in the outer and intermediate layers is within a range from 15 to 55 % by weight and that in the inner layer is within a range from 5 to 50 % by weight.
- 10 4. A multi-layer film composed of a polyolefin resin, comprising:
- (1) an outer layer containing a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- (2) an intermediate layer having at least one layer containing a linear ethylene- α -olefin copolymer having a density of 0.905 g/cm³ or 0.885 g/cm³; and
- 15 (3) an inner layer containing a resin in which 20 to 40 % by weight of polypropylene is contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³ or 0.940 g/cm³;
- wherein a high-density polyethylene having a density of not less than 0.960 g/cm³ is contained in all layers, and an amount of the high-density polyethylene in the outer and intermediate layers is within a range from 15 to 35 % by weight and that in the inner layer is within a range from 5 to 20 % by weight.
- 20 5. The multi-layer film according to claim 4, wherein the outer layer is composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- the intermediate layer is composed of a resin in which 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.905 g/cm³; and
- 25 the inner layer is composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ and 30 % by weight of polypropylene having a density of 0.910 g/cm³ are contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³.
- 30 6. The multi-layer film according to claim 4, wherein the outer layer is composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- the intermediate layer is composed of a resin in which 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.885 g/cm³; and
- 35 the inner layer is composed of a resin in which 14 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ and 33 % by weight of polypropylene having a density of 0.910 g/cm³ are contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³.
- 40 7. The multi-layer film according to claim 4, wherein the outer layer is composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.940 g/cm³;
- the intermediate layer is composed of a first layer of a resin in which 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.905 g/cm³, a second layer of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³ and a third layer of a resin in which 30 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ is contained in a linear ethylene- α -olefin copolymer having a density of 0.905 g/cm³, the first layer, the second layer and the third layer being laminated each other in this order; and
- 45 the inner layer is composed of a resin in which 20 % by weight of a high-density polyethylene having a density of 0.965 g/cm³ and 30 % by weight of polypropylene having a density of 0.910 g/cm³ are contained in a linear ethylene- α -olefin copolymer having a density of 0.930 g/cm³.
- 50 8. The multi-layer film according to any one of claims 5 to 7, wherein the high-density polyethylene having a density of 0.965 g/cm³ has a melt flow rate of 15 g/10 minute (190 °C).
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9. A container molded using the film according to any one of claims 1 to 8.
10. A container comprising two or more chambers, which is molded using the film according to any one of
claims 1 to 8, the respective chambers being partitioned by an easy peelable seal part formed by
5 directly heat-sealing inner surfaces of the above films each other.

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Fig. 1

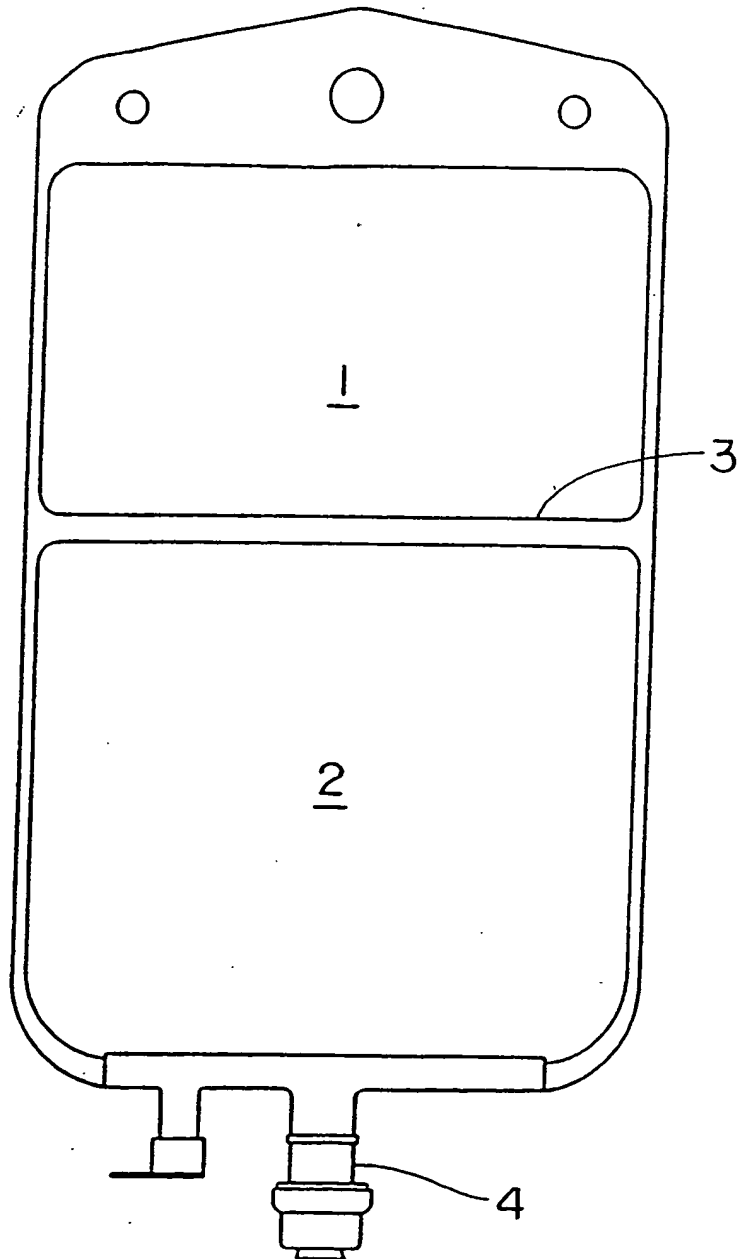
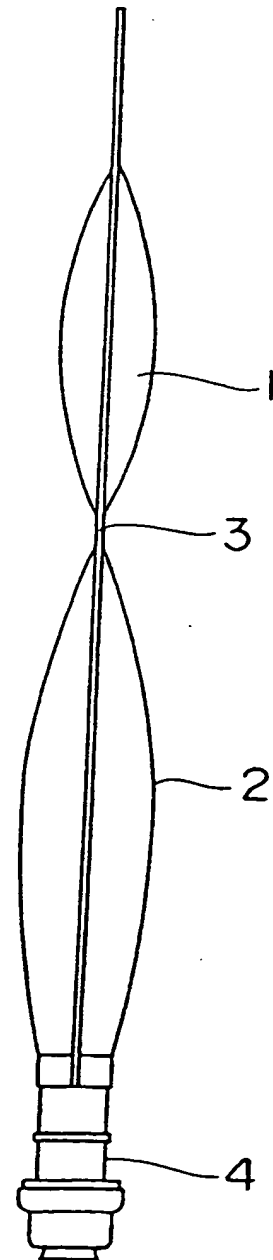


Fig. 2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP94/00144

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl⁵ B32B27/32, B65D65/40, 75/30, 77/08, 81/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl⁵ B32B27/00-27/32, B65D65/40, 75/30, 77/08, 81/32,
C08L23/00-23/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1926 - 1994
Kokai Jitsuyo Shinan Koho 1971 - 1994

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, A, 2-95849 (Tamapoly K.K.), April 6, 1990 (06. 04. 90), Claim, (Family: none)	1-10
A	JP, A, 64-22548 (Okura Kogyo K.K.), January 25, 1989 (25. 01. 89), Claim, (Family: none)	1-10
A	JP, A, 2-150442 (Sumitomo Chemical Co., Ltd.), June 8, 1990 (08. 06. 90), Claim, line 17, lower right column, page 2 to line 17, upper left column, page 3, (Family: none)	1-10
A	JP, A, 3-39332 (The Dow Chemical Co.), February 20, 1991 (20. 02. 91), Claim & EP, A, 405916 & US, A, 5241030 & AU, A, 9057906 & CA, A, 2019876 & FI, A, 9003209 & BR, A, 9003123	1-10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
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 - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search
April 11, 1994 (11. 04. 94)

Date of mailing of the international search report
May 10, 1994 (10. 05. 94)

Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP94/00144

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, A, 59-142963 (CR. Bard Inc.), August 16, 1984 (16. 08. 84), Claim and drawings & GB, A, 2134067 & FR, A, 2539713 & AU, A, 8322775 & SE, A, 8306400	10
A	JP, U, 56-150777 (Dainippon Printing Co., Ltd.), November 12, 1981 (12. 11. 81), Claim, (Family: none)	10

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